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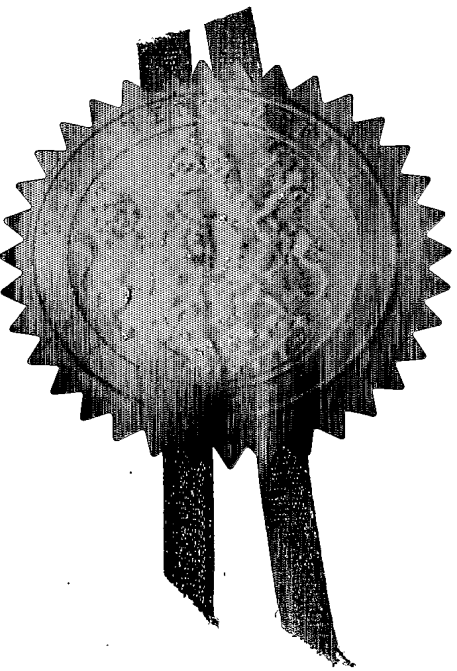

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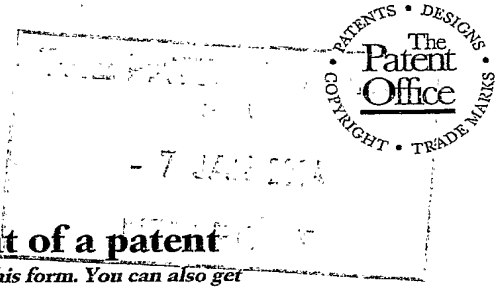

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(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

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07JAN04 E863514-1 B19930
1/7700 0.00-0400206.9 NONE

2. Patent application number
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3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

C-Tech Innovation Ltd
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CHESTER CH1 6EH

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation UK 8510231001

4. Title of the invention SILENT KETTLE

5. Name of your agent *(if you have one)*

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6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

Number of earlier UK application	Date of filing *(day / month / year)*

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request? NO

Answer YES if:

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Otherwise answer NO (See note d)

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Continuation sheets of this form	0
Description	4
Claim(s)	1
Abstract	1
Drawing(s)	1 + 1 SN

10. If you are also filing any of the following, state how many against each item.

Priority documents	–
Translations of priority documents	–
Statement of inventorship and right to grant of a patent (Patents Form 7/77)	–
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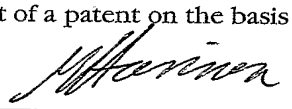
Signature(s)  Date 5-1-04

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

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Silent Kettle

This invention relates to a silent kettle that heats water by passing an electric current through the water, resulting in a heating of the water but with minimal noise generation.

Kettles are well known devices for boiling water. In particular kettles are often powered by electrical energy, being a clean and convenient power source. Kettles are currently designed to give maximum heating rates and efficiency, as well as having an appealing aesthetic appearance. The most usual way to apply electrical energy to heat water in a kettle is via heating elements.

The use of heating elements to rapidly heat water gives high temperature gradients between the element and the water in contact with the heating element, this together with the fact that the heating element provide nucleation points for bubble formation, leads to the creation of many small bubbles of stream which then collapse in the bulk water producing a noise.

A particular technique for heating water know as 'ohmic heating' can be used to heat fluids such as water, and in particular can be used to heat water in a kettle. Heating water using ohmic heating allows rapid highly efficient heating of the water. Ohmic heating heats a fluid highly uniformly, and without any surfaces becoming hot, and thus the use of ohmic heating does not result in the formation of bubbles of steam throughout the majority of the heating cycle, and thus the operation of an ohmically heated kettle is virtually silent, (until the full bulk of the water boils, at which time the heating operation is complete).

Arrangements are known where current is passed through a liquid to cause it to heat. However, ohmic heating is not known to be used to heat fluids for the purpose of heating the fluid silently. Furthermore this technique for heating water will not lead to the formation of precipitates ('furring') in the kettle.

FR964733 discloses an ohmic heater for heating a fluid by passing electricity through it.

According to the present invention there is provided a kettle for heating water or other liquids, incorporating two electrodes, which are energised by connection to a single-phase (or two phases of a three phase) electrical power supply. The electrodes when energised cause current to be passed through the water causing it to be heated (due to its own electrical resistivity). The passage of this electrical current causes the water to be heated but without the formation of bubbles which lead to noise generation. Thus a rapid and silent kettle.

A specific embodiment of the invention will now be described by way of example with reference to the accompanying drawing, which shows a possible arrangement of a silent, ohmically heated kettle.

Referring to the drawing which illustrates an embodiment of the present invention in which electrodes 2 & 3 are arranged to be parallel to the base of the kettle and separated by a distance appropriate to cause a current to be drawn, during normal operation, such as to be at the limit of the electrical supply available to power the kettle; typically a 13 Amp single phase domestic supply. This electrical supply is connected to the electrodes by contact wires 6.

The kettle comprises a kettle main body 1, two electrodes to transfer the electrical power to the water 2 & 3, a lid for the kettle 5 which is interlocked with the main electricity supply to prevent accidental contact of the operator with the electrodes within the kettle. The lid also helps to contain any steam produced during the heating and boiling process. The kettle also comprises a filter unit 4 on the output of the kettle spout, which in addition to its role as a filter, also acts as a device to prevent accidental contact of the operator with the electrodes.

The kettle main body 1 is constructed from a suitable electrically insulating material and of such a wall thickness as to adequately withstand the internal temperatures and pressures which will occur during the heating of the water - for example when the water boils.

The two electrodes 2 and 3 are constructed from a suitable material, chosen so as to minimise corrosion of said electrodes during operation of the kettle, and also to minimise any electrochemical effects which may occur during the heating process. Electrochemical gas generation during normal operation will be very small; any gases produced during the heating process will become mixed with the steam produced by the boiling water and will then be dispersed into the surrounding environment, thus no build-up of gas will occur.

The electrodes 2 and 3 may be made from any suitable material that is compatible with the chemical and electrochemical properties of the fluid to be heated. In general there will be an upper limit to the current density, which any particular electrode material will withstand without damaging the current carrying portion of the electrode or causing the water to react at the electrode surface and adversely affect the operation of the kettle.

One electrode 2 is integral to the base of the kettle. This electrode is connected to the live electrical supply. The other electrode 3, which can be constructed from a solid plate or a perforated plate or mesh, is positioned parallel to the base electrode at an appropriate separation so as to ensure that the current drawn through the water between the two electrodes is at such a level for optimal performance of the kettle.

The dimensions of the electrodes and their spacing also needs to be chosen in such a way as to limit the currents flowing to levels which the electrode / water combination can withstand. Suitable electrode materials have been found to be platinized titanium and various graphite based material. Other materials, which may be chosen to be used, may include steel, stainless steel and titanium. In particular the use of wire or mesh makes easier the process of applying coatings to the electrode materials, so as to improve its performance as an electrode material. Such coatings may includes platinum, or doped diamond coatings.

The use of a perforated or mesh neutral electrode permits any gases evolved to rise up out from between the electrodes, and also allows the water to circulate around the kettle more freely, by natural convection, thus giving a more uniform heat distribution in the water in the kettle, prevented boiling from occurring in localised regions in the kettle, and hence ensuring the silent operation of the kettle.

Suitable dimensions for the electrodes of an ohmically heated, silent kettle are 100mm diameter plates (with 6mm diameter perforations) separated by a distance of 15mm.

Alternative arrangements for the electrodes in the silent kettle include parallel electrodes in a vertical orientation (rather then the horizontal arrangement described above), and also concentric electrodes, (where the electrode connected to the live electricity supply would usually be the inner electrode with the neutral electrode positioned around it).

In order to maximise the heating power input to the water in the silent kettle, it is beneficial to include a method of tuning the kettle to suit the particular water being heated at any time. The electrical conductivity of potable water varies across different regions / countries, dependant on how the water is sourced. Tuning of the kettle will be required to ensure that the kettle operates at maximum power dependant upon the conductivity of the water to be heated. Tuning can be performed by mechanical or electronic means, and can be performed continuously throughout the heating cycle or can be performed before heating occurs as a one off operation.

Mechanical tuning techniques include varying the separation of the electrodes or the electrode area, and are particularly suitable for one off tuning operations. The electrode separation can be varied to such a position such as to cause the current being drawn, during normal operation, to be at the limit of the electrical supply available to power the kettle; typically a 13 Amp single phase domestic supply. This can be done using cold water straight from the water supply, and the optimum position can be indicated by comparing the resistance of the water between the electrodes to a fixed resistance of appropriate magnitude for the electrical supply to be used.

A number of electronic tuning techniques can be used, such as a system where the current being drawn is monitored and is used to control the active area of the electrodes being used, for example by using a number of

concentric electrodes which can be switched on or off so as to give the appropriate electrode area for the water being heated.

Other techniques for optimising heating rates include the use of parallel or series resistance elements to act as an electrical ballast.

Other devices which may be incorporated in a silent ohmically heated kettle include a means of making and breaking the electrical contact to the neutral electrode, so that an electric circuit is only made when the kettle's lid is fitted correctly, and is broken when the lid is removed. This will prevent accidental contact of the kettle's operator with the electrodes or water within the kettle. The kettle should also comprise a filter unit on the output of the kettle spout, which in addition to its role as a filter, also acts as a device to prevent accidental contact of the operator with the electrodes.

Additionally a tilt switch may be added which will cut the electrical power to the kettle when it is tilted, for example to pour out the water. This will prevent water being poured out of the kettle whilst electrical power is connected.

As well as using the described heating arrangement, tuning and safety systems for a silent kettle, the systems described can also be used for heating water (and other liquids) in equipment such as in-line water heaters, coffee machines and showers. The technique will also be beneficial in that it will heat water without the formation of precipitates ('furring') in the kettle.

CLAIMS

1 A heating device for water or other liquids, incorporating two electrodes, which are energised by connection to a single-phase (or two phases of a three phase) electrical power supply, the electrodes when energised cause current to be passed through the water causing it to be heated (due to its own electrical resistivity), the passage of this electrical current causes the water to be heated but without the formation of bubbles which lead to noise generation, thus a rapid and silent kettle

2 A method of operating an ohmically heated silent kettle as claimed in Claim 1 wherein the current between electrodes 2 and 3 can be varied by the adjustment of the separation of said electrodes to tune the kettle for optimum performance

3 A method of operating an ohmically heated silent kettle as claimed in Claim 1 wherein the current between electrodes 2 and 3 can be varied by the adjustment of the area of said electrodes to tune the kettle for optimum performance

4 A method of operating an ohmically heated silent kettle as claimed in Claim 1 wherein the current between electrodes 2 and 3 can be varied by electronic monitoring and control techniques to tune the kettle for optimum performance

5 An ohmically heated silent kettle as claimed in Claim 1 wherein said vessel is electrically insulating

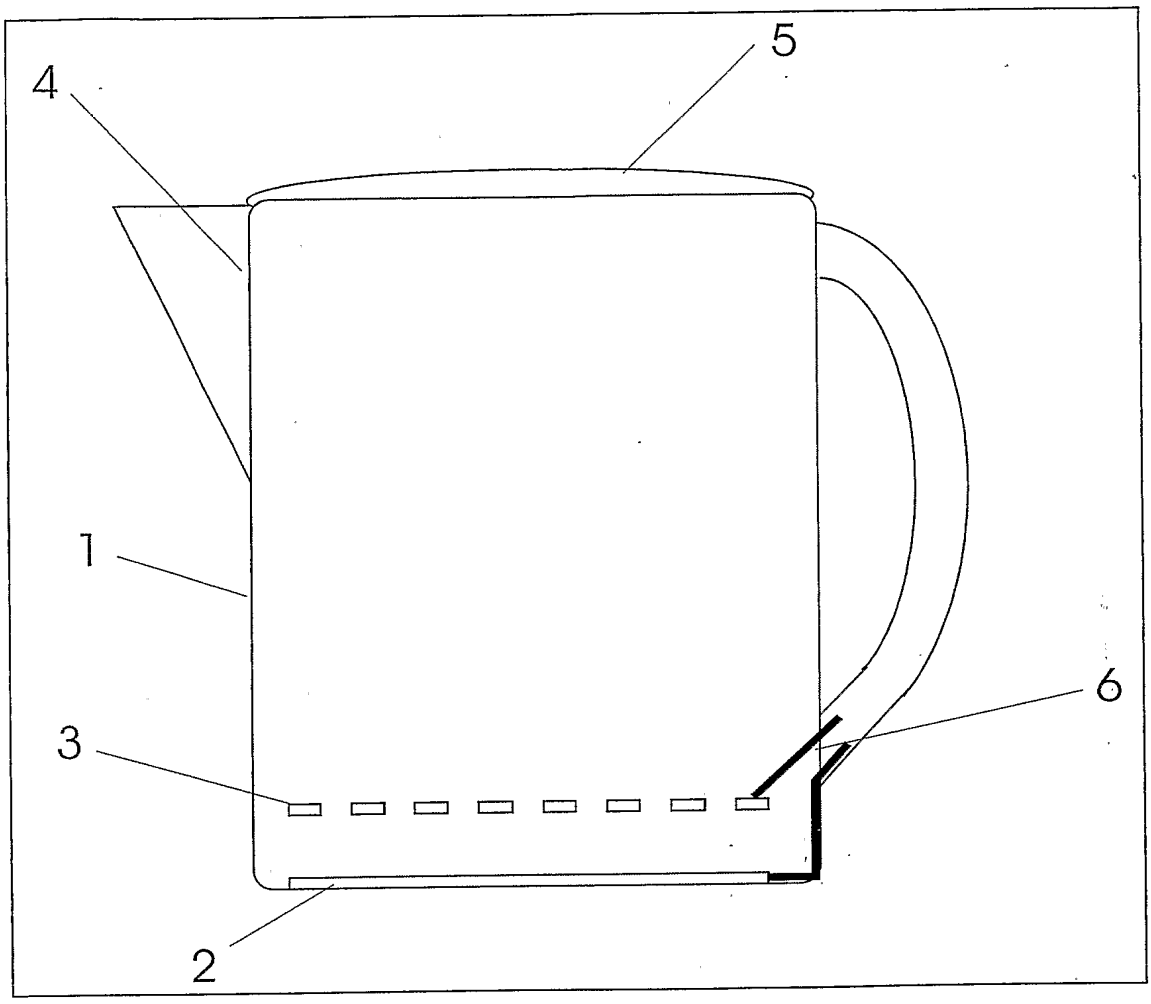
6 A silent heating technique which could be employed for heating water (and other liquids) in equipment such as in-line water heaters, coffee machines and showers.

7 A silent heating technique for heating water causes the heating of the water without the formation of precipitates ('furring')

ABSTRACT

Silent Kettle

A kettle, for heating water or other liquids, which utilises ohmic heating of the water within the kettle, where electrical current is passed directly through the water which becomes heated due to its natural electrical resistivity. The passage of the electrical current through the water causes it to be heated rapidly and efficiently but without the formation of bubbles that lead to noise generation. Thus a rapid and silent kettle.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